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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/698,797	10/27/2000	Damian Bevan	476-1810.1	5129

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EXAMINER	
WARE, CICELY Q	

ART UNIT	PAPER NUMBER
2634	4

DATE MAILED: 12/23/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/698,797	BEVAN ET AL.	
	Examiner	Art Unit	
	Cicely Ware	2634	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12 December 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-30* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4,6-16 and 19-30* is/are rejected.

7)☒ Claim(s) *5,17 and 18* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *12 December 2003* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

13)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

a) ☐ The translation of the foreign language provisional application has been received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *1* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

Drawings

1. This application has been filed with informal drawings, which are acceptable for examination purposes only. Formal drawings will be required when the application is allowed.

Specification

2. The disclosure is objected to because of the following informalities:

a. Pg. 1, line 27, applicant uses "capitalise". Examiner suggests using "capitalize". Applicant makes use of this type of error throughout the disclosure. Examiner suggests applicant correct all utterances for clarification purposes.

b. Pg. 2, lines 4,7,10,26, applicant uses "realisations" and "minimise". Examiner suggests using "realizations" and "minimize". Applicant makes use of this type of error throughout the disclosure. Examiner suggests applicant correct all utterances for clarification purposes.

c. Pg. 2, line 30, applicant uses the phrase "supported is in inverse". Examiner suggests using "supported is, an inverse" for clarification purposes.

d. Pg. 3, line 30, applicant uses "Issues". Examiner suggests using "issues".

e. Pg. 3, line 32, applicant uses "Increase". Examiner suggests using "increase.

f. Pg. 3, line 35, examiner suggests inserting a space between "Figure 1."

and "Coded".

g. Pg. 6, line 11, applicant uses "hypothesised". Examiner suggests using "hypothesized". Applicant makes use of this type of error throughout the disclosure. Examiner suggests applicant correct all utterances for clarification purposes.

h. Pg. 7, line 9-10, applicant uses the phrase "decreases as the inverse". Examiner suggests using "decreases with the inverse".

i. Pg. 12, line 24, examiner suggests deleting the space between"13 A".

j. Pg. 21, line 24, examiner suggests applicant re-write this line for clarification purposes.

3. The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Appropriate correction is required.

Claim Objections

4. Claim 1 is objected to because of the following informalities:

a. Applicant has incorrectly lettered the elements of the apparatus. Applicant uses (a,d,b,c,c). Examiner suggests and assumes (a,b,c,d,e).

Appropriate correction is required.

5. Claims 10 and 19 are objected to because of the following informalities:

a. Pg. 33, line 30, Pg. 35, 3, examiner suggests applicant delete the "-".

Appropriate correction is required.

Claim Rejections - 35 USC § 112

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter, which the applicant regards as his invention.

7. Claims 1-18 recite the limitation

a. the modulation alphabet, in Claim 4.

b. the expected effect of the transmissions, in Claim 10.

c. the other channels, in Claim 10.

d. the relevant parts, in Claim 10.

e. the expected effect of modulation, in Claim 10.

f. the complex conjugate, in Claim 17.

There is insufficient antecedent basis for this limitation in the claim.

8. Claims 10,19, 25, 27, 28 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for using "relatively". Relatively is a broad and indefinite limitation and does not enclose a specific boundary.

Claim Rejections - 35 USC § 102

9. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

10. Claims ~~10~~ 3 103 w/ Perreau ,11,16, 25, 30 rejected under 35 U.S.C. 102(a) as being anticipated by Calderbank et al. (US Patent 6,125,427).

(1) With regard to claim 10, Calderbank et al. discloses a method of estimating complex channel gain in a space-time communications system comprising the steps of: generating an initial, relatively coarse estimate of channel gain (col. 16, lines 20-39), receiving space-time encoded information symbols over the channels (col. 16, lines 20-39, 64-67), decoding the information symbols using the initial channel estimate to produce a sequence of symbol estimates (col. 16, 20-39, 64-67), refining the channel estimate for each channel, by processing the received symbols to remove the expected effect of the transmission s carried by all the other channels by performing cancellation using the relevant parts of the sequence of symbol estimates and to remove the expected effect of modulation on each symbol and by averaging the channel estimates over all symbols for each respective channel to produce a refined estimate for each channel (col. 11, lines 1-29, col. 12, lines 10-67, col. 13, lines 1-64, col. 15, lines 63-66, col. 16, lines 20-39, col. 16, lines 64-67, col. 17, lines 1-11, col. 18, lines 5-14, 34-42, 54-59), decoding the information symbols again using the refined channel estimate to

produce a refined sequence of coded symbol estimates (Fig. 22), repeating steps (d), (e), and (f) until convergence (col. 18, lines 54-59).

(2) With regard to claim 11, claim 11 inherits all the limitations of claim 10. Calderbank et al. further discloses in (Fig. 22) a method wherein the decoding step includes performing hard decoding to produce hard symbol estimates. Calderbank et al. does not explicitly disclose hard decoding. However it is well known in the art that a Viterbi decoder acts as a hard decoder to produce hard symbol estimates

(3) With regard to claim 16, claim 16 inherits all the limitations of claim 10. Calderbank et al. further discloses in (Fig. 22) wherein the initial estimate is generated bases on a relatively short, transmitted pilot or training sequence (col. 19, lines 15-49).

(4) With regard to claim 25, claim 25 inherits all the limitations of claim 10. Furthermore Calderbank et al. discloses wherein a computer program which, when executing on suitably configured hardware, causes the hardware to perform the steps of claim 10 (col. 4, lines 31-42). Calderbank et al. does not explicitly disclose a computer program. However Calderbank et al. discloses wherein the embodiments are constructed using hardware, which is inherently programmed by software performing the operations.

(5) With regard to claim 30, Calderbank et al. discloses software stored on a machine readable medium operable to encode a stream of data and which is operable to output encoded data wherein the software is programmed to function as a convolutional encoder operable to sequentially group data to provide coded bits, which coded bits are mapped to provide modulated symbols (col. 4, lines 32-42, 50-65).

11. Claim 29 is rejected under 35 U.S.C. 102(a) as being anticipated by Cimini, Jr. et al. (US Patent 6,208,669).

With regard to claim 29, Cimini, Jr. et al. discloses in (Fig. 3) a communication system in which an integrated chip programmed so as to operable to encode a stream of data and which is operable to output encoded data wherein the chip comprises a convolutional encoder operable to sequentially group data to provide coded bits, which coded bits are mapped to provide modulated symbols which then are de-multiplexed to form space-time symbols (col. 3, lines 7-40, col. 7, lines 5-11, 18-22).

Claim Rejections - 35 USC § 103

12. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

13. Claims 1, 2, 4 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Calderbank et al. (US Patent 6,115,427) in view of Cimini, Jr. et al. (US Patent 6,208,669).

(1) With regard to claim 1, Calderbank et al. discloses in (Figs. 8, 9) a space-time coding apparatus (col. 9, lines 17-21, 26-28, col. 17, lines 38-49) comprising: a data input (col. 2, line 24, col. 9, lines 17-21, 26-28), a plurality of signal outputs couplable to a respective plurality of transmit antennas (col. 2, line 24, col. 9, lines 17-21, 26-28), a

trellis encoder implemented using a convolutional encoder and arranged to receive data from the data input and to produce encoded data in the form of code symbols (Fig, 9 (106), col. 9, lines 17-21, 26-28, col. 16, lines 1-20), a modulator arranged to map the encoded data to predetermined modulation symbols (Fig. 8 (114a, 114b)). However Calderbank et al. does not disclose a de-multiplexer arranged to de-multiplex the modulation symbols to the signal outputs.

However Cimini, Jr. et al. discloses an apparatus wherein (Fig. 3, (306)) a de-multiplexer is arranged to de-multiplex the modulation symbols to the signal outputs col. 7, lines 18-22).

Therefore it would have been obvious to one of ordinary skill in the art to modify Calderbank et al. to incorporate a de-multiplexer arranged to de-multiplex the modulation symbols to the signal outputs in order to pass selected symbols to selected channels, which is the dividing up of information between channels.

(2) With regard to claim 2, claim 2 inherits all the limitations of claim 1. Calderbank et al. further discloses in (Fig. 9) wherein the convolutional encoder is arranged to generate two code symbols for each data bit input to the trellis encoder and wherein the two coed symbols are alternately switched to an output of the trellis encoder (col. 9, lines 63-67, col. 10, lines 1-16).

(3) With regard to claim 4, claim 4 inherits all the limitations of claim 1. Calderbank et al. further discloses wherein the rate of the convolutional encoder and the modulation alphabet of the modulator is such that the number of modulation symbols produced for each trellis transition is greater then the number of signal outputs so that

more that one space-time symbol is produced for each trellis transition, whereby the apparatus is arranged to produced multidimensional space-time codes (col. 19, lines 64-67, col. 20, lines 1-50).

(4) With regard to claim 6, claim 6 inherits all the limitations of claim 1. Calderbank et al. further discloses a method of space-time encoding comprising operating the modulator to map the encoded signals to QPSK symbols to provide modulated signals (col. 18, lines 14).

14. Claims 3 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Calderbank et al. (US Patent 6,115,427) in combination with Cimini, Jr. et al. (US Patent 6,208,669) as applied to claims 1 and 6 above, and further in view of Wei (US Patent 5,301,209).

(1) With regard to claim 3, claim 3 inherits all the limitations of claim 1. Calderbank et al. in combination with Cimini, Jr. et al. disclose all the limitations of claim 1. However Calderbank et al. in combination with Cimini, Jr. et al. do not disclose wherein the data input receives binary data which is grouped into four-bit data blocks, each block representing a single trellis transition, and the convolutional encoder is arranged to produced eight 1-bit code symbols for each four-bit data block, the modulator being arranged to map the eight code symbols to four QPSK symbols to form a single space-time symbol.

However Wei discloses in (Figs. 1, 5) wherein the data input receives binary data which is grouped into four-bit data blocks, each block representing a single trellis

transition, and the convolutional encoder is arranged to produced eight 1-bit code symbols for each four-bit data block, the modulator being arranged to map the eight code symbols to four QPSK symbols to form a single space-time symbol.

Therefore it would have been obvious to one of ordinary skill in the art to modify Calderbank et al. in combination with Cimini, Jr. et al. to incorporate the data input receiving binary data which are grouped into four-bit data blocks, each block representing a single trellis transition, and the convolutional encoder arranged to produced eight 1-bit code symbols for each four-bit data block, the modulator being arranged to map the eight code symbols to four QPSK symbols to form a single space-time symbol in order to minimize the decoding depth and improve the error-rate performance of the code in which the resulting code is more suitable for fading channel applications.

(2) With regard to claim 8, claim 8 inherits all the limitations of claim 6 above. Wei further discloses in (Fig. 6) wherein the trellis encoder comprises a convolutional encoder having a shift register with two parts operable to generate two code signals for each data bit input to the trellis encoder, wherein the code signals are encoded by a generator function, wherein the two coded signals are switched to an output of the encoder.

15. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Calderbank et al. (US Patent 6,115,427) in combination with Cimini, Jr. et al. (US Patent

6,208,669) as applied to claim 6 above, and further in view of Wei (US Patent 5,056,112).

With regard to claim 7, claim 7 inherits all the limitations of claim 6. Calderbank et al. in combination with Cimini, Jr. et al. disclose all the limitations of claim 6. However Calderbank et al. in combination with Cimini, Jr. et al. do not disclose wherein the input receives binary data and the convolutional encoder groups sequentially input data into quaternary groups, which are processed by the encoder to provide eight-bit data groups which are subsequently converted to QPSK symbols.

However Wei discloses in (Fig. 4) wherein the input receives binary data and the convolutional encoder groups sequentially input data into quaternary groups, which are processed by the encoder to provide eight-bit data groups, which are subsequently converted to QPSK symbols (col. 4, lines 19-22, 25-32, 40-43, 56-61).

Therefore it would have been obvious to one of ordinary skill in the art to modify Calderbank et al. in combination with Cimini, Jr. et al. to incorporate the input receives binary data and the convolutional encoder groups sequentially input data into quaternary groups, which are processed by the encoder to provide eight-bit data groups, which are subsequently converted to QPSK symbols in order to produce a set of interdependent signal points, one signal point in each signaling interval, so that at most one signal point of a codeword is lost, it is possible to recover the transmitted information. Information about the input data appears redundantly in the time domain with the coded signal, which improves the error performance in a fading channel environment.

16. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Calderbank et al. (US Patent 6,115,427) in view of Cimini, Jr. et al. (US Patent 6,208,669).

With regard to claim 9, Calderbank et al. discloses in (Figs. 8, 9) a method of space-time encoding a data stream comprising the steps of: trellis encoding a data stream using an optimal binary convolutional code of predetermined constraint length, modulating the encoded data by mapping the encoded data stream to modulation symbols selected from a predetermined modulation alphabet (Fig. 9). However Calderbank et al. does not disclose de-multiplexing the modulation symbols to a plurality of transmit antennas.

However Cimini, Jr. et al. discloses in (Fig. 3) de-multiplexing the modulation symbols to a plurality of transmit antennas.

Therefore it would have been obvious to one of ordinary skill in the art to modify Calderbank et al. to incorporate de-multiplexing the modulation symbols to a plurality of transmit antennas in order to pass selected symbols to selected channels, which is the dividing up of information between channels.

17. Claims 12-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Calderbank et al. (US Patent 6,115,427) as applied to claim 10 above, in view of Brink (US Patent 6,353,911).

(1) With regard to claim 12, claim 12 inherits all the limitations of claim 10.

However Calderbank et al. does not disclose wherein the decoding step includes performing soft decoding by producing a sequence of coded symbol probabilities which are then used to calculated symbol estimates in the form of a sequence of coded symbol averages.

However Brink discloses in (Fig. 2) wherein the decoding step includes performing soft decoding by producing a sequence of coded symbol probabilities, which are then used to calculated symbol estimates in the form of a sequence of coded symbol averages (col. 4, lines 43-51).

Therefore it would have been obvious to one of ordinary skill in the art to modify Calderbank et al. to incorporate the decoding step to perform soft decoding by producing a sequence of coded symbol probabilities, which are then used to calculated symbol estimates in the form of a sequence of coded symbol averages to improve the bit error rate through iterative decoding until a bit error rate floor is reached. A soft value represents the reliability on the bit decision of the respective bit symbol.

(2) With regard to claim 13, claim 13 inherits all the limitations of claim 12. Brink further discloses in (Fig. 1) where in after convergence the coded symbol probabilities calculated in the last decoding step of the iteration loop are output for feeding to the input of the next decoder in a serially-concatenated decoder arrangement (col. 1, lines 51-67, col. 2, lines 1-10).

(3) With regard to claim 14, claim 14 inherits all the limitations of claim 10. Brink further discloses in (Fig. 1) wherein after convergence, hard decisions on the information symbols are made using the final channel estimate (col. 4, lines 43-51).

(4) With regard to claim 15, claim 15 inherits all the limitations of claim 10. Brink further discloses in (Fig. 2) wherein after convergence the information bits are decoded using the final channel estimate (col. 4, lines 43-51).

18. Claims 19-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Calderbank et al. (US Patent 6,115,427) as applied to claim 10 above, in view of Brink (US Patent 6,353,911).

(1) With regard to claim 19, Calderbank et al. discloses in (Fig. 18) an apparatus for a space-time communications system comprising: an initial estimator operable to generate an initial, relatively coarse estimate of channel gain (col. 18, lines 23-36), a receiver operable to receive space-time encoded information symbols (col. 18, lines 23-36), a decoder operable to produce a sequence of coded symbol estimates using a channel estimate (col. 18, lines 23-36) and estimate refining means operable to refine the channel estimate for each channel by processing, by processing the received symbols to remove the expected effect of the transmission s carried by all the other channels by performing cancellation using the relevant parts of the sequence of symbol estimates and to remove the expected effect of modulation on each symbol and by averaging the channel estimates over all symbols for each respective channel to produce a refined estimate for each channel (col. 11, lines 1-29, col. 12, lines 10-67, col. 13, lines 1-64, col. 15, lines 63-66, col. 16, lines 20-39, col. 16, lines 64-67, col. 17, lines 1-11, col. 18, lines 5-14, 34-42, 54-59). However Calderbank et al. does not

disclose the apparatus being arranged to iteratively repeat the refining of the channel estimation and the production of symbol estimate functions until convergence of the channel estimates occurs.

However Brink discloses in (Figs. 1, 2) the apparatus being arranged to iteratively repeat the refining of the channel estimation and the production of symbol estimate functions until convergence of the channel estimates occurs (abstract, col. 1, lines 50-67, col. 2, lines 1-10, col. 4, lines 43-51).

Therefore it would have been obvious to one of ordinary skill in the art to modify Calderbank et al. to incorporate the apparatus being arranged to iteratively repeat the refining of the channel estimation and the production of symbol estimate functions until convergence of the channel estimates occurs because an improvement in the bit error rate may be achieved with each iterative decoding step until a BER floor is reached.

(2) With regard to claim 20, claim 20 inherits all the limitations of claim 19. Calderbank et al. further discloses in (Fig. 18) wherein the decoder is operable to perform hard decoding to produce hard symbol estimates. Calderbank et al. does not explicitly disclose hard decoding. However it is well known in the art that a Viterbi decoder acts as a hard decoder to produce hard symbol estimates.

(3) With regard to claim 21, claim 21 inherits all the limitations of claim 19. Brink further discloses in (Fig. 2), wherein the decoder is operable to perform soft decoding by producing a sequence of coded symbol probabilities, which are then used to calculated symbol estimates in the form of a sequence of coded symbol averages (col. 4, lines 43-51).

(4) With regard to claim 22, claim 22 inherits all the limitations of claim 21. Brink further discloses in (Fig. 1) wherein the decoder is operable to output the coded symbol probabilities calculated for feeding to the input of the next decoder in a serially-concatenated decoder arrangement (col. 1, lines 51-67, col. 2, lines 1-10).

(5) With regard to claim 23, claim 23 inherits all the limitations of claim 19. Brink further discloses in (Fig. 1) wherein the decoder is arranged to produce, hard decisions on the information symbols are made using the final channel estimate (col. 4, lines 43-51).

(6) With regard to claim 24, claim 24 inherits all the limitations of claim 19. Brink further discloses in (Fig. 2) wherein after convergence, the decoder is operable to decode the information bits are decoded using the final channel estimate (col. 4, lines 43-51).

19. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Calderbank et al. (US Patent 6,115,427) in view of Cimini, Jr. et al. (US Patent 6,208,669).

With regard to claim 26, Calderbank et al. discloses in (Figs. 21, 22) a communications system arranged to use space-time coding and comprising transmitter apparatus and receiver apparatus (col. 2, lines 22-24), the transmitter apparatus further comprising an input col. 2, line 24), a trellis encoder and a plurality of signal outputs wherein the input is operable to receive a stream of data (Fig. 3), the trellis encoder operable to encode the data and is operable to output encoded data and wherein the

trellis encoder comprises a convolutional encoder operable to sequentially group data to provide coded bits which encoded data is mapped to provide modulated symbols (col. 2, lines 55-58, col. 20, lines 59-67) . However Calderbank et al. does not disclose a de-multiplexer operable to switch signals to the set of signal outputs.

However Cimini, Jr. et al. discloses in (Fig. 3, (306)) a de-multiplexer operable to switch signals to the set of signal outputs (col. 7, lines 18-22).

Therefore it would have been obvious to one of ordinary skill in the art to modify Calderbank et al. to incorporate a de-multiplexer operable to switch signals to the set of signal outputs in order to pass selected symbols to selected channels, which is the dividing up of information between channels.

20. Claims 27 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Calderbank et al. (US Patent 6,115,427) in combination with Cimini, Jr. et al. (US Patent 6,208,669) as applied to claims 19 and 26 above, and further in view of Brink (US Patent 6,353,911).

(1) With regard to claim 27, claim 27 inherits all the limitations of claims 19 and 26. Calderbank et al. in combination with Cimini, Jr. et al. disclose all the limitations of claim 26. However Calderbank et al. in combination with Cimini, Jr. et al. do not disclose the apparatus being arranged to iteratively repeat the refining of the channel estimation and the production of symbol estimate functions until convergence of the channel estimates occurs.

However Brink discloses in (Figs. 1, 2) the receiver apparatus being arranged to iteratively repeat the refining of the channel estimation and the production of symbol estimate functions until convergence of the channel estimates occurs (abstract, col. 1, lines 50-67, col. 2, lines 1-10, col. 4, lines 43-51).

Therefore it would have been obvious to one of ordinary skill in the art to modify the inventions of Calderbank et al. in combination with Cimini, Jr. et al. to incorporate the receiver apparatus being arranged to iteratively repeat the refining of the channel estimation and the production of symbol estimate functions until convergence of the channel estimates occurs because an improvement in the bit error rate may be achieved with each iterative decoding step until a BER floor is reached.

(2) With regard to claim 28, claim 28 inherits all the limitations of claims 26 and 27. 19

Allowable Subject Matter

21. Claims 5,17 and 18 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Cicely Ware whose telephone number is 703-305-8326. The examiner can normally be reached on Monday – Friday, 8-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen Chin can be reached on 703-305-4714. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9314 for regular communications and 703-872-9314 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-305-3900.

Cicely Ware

cqw
December 15, 2003

STEPHEN CHIN
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